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Published in:
The Innovation Journal

Publication date:
2015

[Link to publication](#)

Citation for pulished version (APA):

Nissen, H. A., Evald, M. R., & Clarke, A. H. (2015). Firms' reshaping of commercialization practices to overcome the 'not invented here' phenomenon in public healthcare organizations. *The Innovation Journal*, 20(3), 1-27. [4].

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Firms' reshaping of commercialization practices to overcome the 'not invented here' phenomenon in public healthcare organizations

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ABSTRACT

The present study is rooted in Public Private Innovation (PPI) projects where public hospitals and private firms engage in cross-sector collaboration with a view to developing new welfare solutions targeting public sector needs. Research into PPI is mainly focused on public management of innovation processes. Consequently, PPI is rarely examined from a private sector perspective, including how private firms seek to commercialize new innovations after co-creating these innovations in collaboration with public organizations. However, commercialization is a critical aspect of innovation because it embraces the learning process whereby newly developed innovations are put into use in society so that they may create value for citizens as well as public servants while generating value in private firms. This article contributes to the literature on collaborative innovation in the public sector by elucidating how private firms commercialize co-created welfare solutions. The empirical setting is a multiple case study consisting of four PPI projects conducted in public Danish healthcare. The findings reveal that PPI firms experience the 'not invented here' (NIH) phenomenon across Danish hospitals. This phenomenon appears in the short run to hamper the firms' commercialization of new welfare innovations. However, in the longer run, firms respond to NIH by reshaping their commercialization practices as they redirect their focus towards the potential benefits of exporting their new welfare solutions to international healthcare systems.

Key words: Commercialization, public-private innovation, not invented here, collaborative innovation.

Introduction

Public innovation is becoming a central topic on the political agenda in many Western countries. Innovation in the public sector often focuses on improvement of public services with a view to better meeting the needs of the citizens who demand better and more individualized public solutions (Sørensen and Torfing, 2012). Increasingly, public innovation is embedded in collaborative innovation projects that involve both public and private sector actors (Ansell and Torfing, 2014), also coined Public Private Innovation (hereafter PPI). Specifically, PPI refers to public and private actors collaborating as development partners throughout an innovation process to develop new solutions targeting public sector needs (Nissen et al., 2014; Weihe et al., 2011). Thus, PPI is based on collaborative innovation in which public and private actors jointly accommodate the development of new ideas and products in ways that strengthen public services. The institutionalization of PPI is observable particularly in the growing establishment of publicly funded PPI projects within Danish public healthcare (Brogaard and Petersen, 2014),

and in the establishment of ministerial and regional healthcare innovation units. Equally, there has been an increased political focus on the use of PPI projects as an approach to developing new welfare solutions needed to meet future demographic challenges associated with an increasingly aging population (Klitkou, 2011).

Enhancing public innovation through the use of collaborative cross-sector innovation in the form of PPI projects has also gained increasing attention in academic research across different research fields (Evald et al., 2014). In particular, the focus has been on policy networks (Sørensen and Torfing, 2011; Kickert et al., 1997; Rhodes, 1997) and inter-organizational relationships aiming to enhance public innovation through collaboration between public and private actors (Nissen et al., 2014; Ansell and Torfing, 2014; Le Ber and Branzei, 2010; Pol and Ville, 2009; Edelenbos and Klijn, 2007). Thus, extant research into PPI primarily focuses on how public managers manage innovation processes at the stage where a new innovation is being developed through collaboration between public and private actors. PPI has rarely been examined from a private sector perspective, including how private firms seek to commercialize new welfare solutions to generate public innovation (Evald, 2014). As such, what is most frequently examined in current PPI literature is the phase or aspect of the innovation process in which a new solution is being developed. However, innovation processes do not merely include the creation of a new invention, but also its commercialization, i.e. the process by which the new 'invention' is turned into an innovation when introduced to a market where it is put into use and thereby generates commercial value (Smith, 2010; Rothwell, 1994; Van de Ven, 1989; Schumpeter, 1939, 1934). How to put the innovation into use is thus tightly connected to how private firms commercialize their welfare innovations. However, new innovations often do not make it to the market and are therefore never put into use. Accomplishing this requires successful commercialization where the new innovations are diffused, and the prerequisite for this is the users' and buyers' adoption of the innovations (Smith, 2010; Hall, 2005). To explain why new innovations are not commercialized broadly in a market, the innovation literature often emphasizes the 'not invented here' (NIH) phenomenon (Katz and Allen, 1982). In the innovation literature, 'not invented here' (NIH) is known as a constraint on organizations' capability to adopt new innovations (Cohen and Levinthal, 1990; Katz and Allen, 1982). Within healthcare in particular, NIH is typically described as dominant among health professionals who often tend to maintain a 'we know best' mindset, resulting in a NIH stance that constrains the adoption of external knowledge because internal knowledge is preferred (Chilingerian et al., 2005; McNeill, 2013; Maccoby et al., 2013).

In order to compensate for the neglect of research into commercialization of innovations developed through PPI, this article endeavors to investigate how firms seek to commercialize new welfare innovations. We do this by emphasizing the obstacles that some firms experience in their efforts to commercialize their products and services. Specifically, we focus on a group of firms that have stated that they have experienced a NIH stance on the part of Danish hospitals when seeking to commercialize their welfare innovations within Danish public healthcare. Therefore, the research question is: *How do firms experience and respond to what they perceive as a NIH phenomenon at Danish hospitals when aiming to commercialize new welfare innovations?*

This study investigates how firms engaged in PPI projects seek to commercialize welfare innovations within the healthcare system *after* developing these innovations in collaboration with public actors and selling these innovations to their direct public partners. As such, the study looks at the part of the commercialization process in which private firms have to bring their solution to the wider public healthcare market where a prerequisite for success is the users' and buyers' adoption of the new innovation (Smith, 2010; Hall, 2005). Also, as the study takes the perspective of the firms and elucidates their experience with and responses to the NIH phenomenon, we do not investigate the rationale involved in the rejection of new innovations from a public sector perspective.

First, the theoretical framework is provided. The concept of PPI is explained through the theoretical lens of collaborative innovation literature. This includes theoretical concepts of networked governance combined with private firms' networked commercialization, both emphasizing an outward-going innovation approach. In addition, NIH is briefly discussed to highlight why public and private actor collaboration remains challenging despite joint interests in collaborative innovation. Next, the research design is described arguing for the appropriateness of a multiple case study in which the main emphasis is on a case that clearly illustrates how a PPI firm experiences NIH while seeking to commercialize a welfare solution across Danish hospitals. Finally, we present and discuss our findings and draw our conclusions.

Theory

Current literature on PPI is mainly concerned with how to manage the development of new innovations, and it typically adopts a public management perspective (Evald, 2014). A considerable share of the literature relates to the practice of managing innovation processes that count on the participation of both public and private actors as public managers may experience barriers related to the actors' lack of experience with such collaboration (Sørensen and Torfing, 2012; Ansell and Gash, 2008). Public managers need to facilitate collaborative interaction and spur ideation in order to overcome the various barriers to collaboration throughout the development of a new innovation (Crosby and Bryson, 2010). What is just as important to explore - but has been neglected so far - is research into how firms that are engaged in PPI handle the commercialization of new innovations after these innovations have been developed through collaborative efforts counting both public and private actors (Evald, 2014). Addressing this call seems pivotal as firms often perceive commercialization as a challenging endeavor when they aim to commercialize and diffuse welfare innovations within Danish healthcare.

There is no doubt that the most critical element in the innovation process is when new innovations are diffused and put into practical use in society through commercialization (Hall, 2005; Van de Ven, 1989). In particular, private firms may see the commercialization process as inhibited because an NIH orientation in organizations may constrain the diffusion of new innovations across organizations in society (Katz and Allen, 1982). In order to identify key aspects about the NIH phenomenon, we will explore what lies behind the concept of NIH. First, however, networked governance and networked commercialization are explained as these approaches, which characterize both the public and private sector, are both directed by a network logic that is oriented towards an out-bound rather than an in-bound focus (Sørensen and Torfing,

2012; Vargo and Lusch, 2008). The term ‘logic’ here describes the taken-for-granted ways that organizations and individuals in society behave and organize (Friedland and Alford, 1991) and which seems to characterize the reasons why the actors engage in PPI.

A network logic that guides co-creation of innovations across the public and private sector

Throughout history, the development of new innovations has been characterized by complex processes involving interaction between different kinds of actors (Bijker, 1995). As such, new innovations are rarely developed in isolation from the external environment, but rather through interaction with different actors in society (Jæger, 2011). In accordance herewith, the public sector is oriented towards its external environment to enhance public innovation in healthcare. Through networked governance, the public sector employs cross-sector collaboration, partnerships, and other types of relationships between relevant actors. This may contribute to the development and diffusion of innovation in public policies and services (Sørensen and Torfing, 2012; Eggers and Singh, 2009; Moore and Hartley, 2008). This networked approach has also characterized the development of innovation in the private sector where firms’ value creation and commercialization efforts have moved from a firm-centric focus to one of collaboration with actors (e.g. potential customers) in the external environment (Vargo and Lusch, 2008, 2004). Both the public and the private sector appear to be directed by a network logic that guides public and private organizations toward interaction with external actors. This is especially evident in the growing establishment of PPI projects. In the below table, the historical and recent development that both public sector organizations and private firms have experienced is summarized. Furthermore, the table presents a distinction (marked in red) between public organizations’ networked governance approach on the one hand and private firms’ networked commercialization approach on the other.

Table 1: The networked governance approach versus the networked commercialization approach

	<i>Public organizations</i> Shift from an inward orientation to networked governance			<i>Private firms</i> Shift from an inward orientation to networked commercialization	
Approach	Traditional bureaucracy	New public management	Networked governance	Inward orientation	Networked commercialization
Characteristic	Rule-bound bureaucratic control focused on regulation	Managerialism focused on market mechanisms	Co-development through interaction with external actors	Firm-centric focus on planned commercialization strategy	Co-development and commercialization through interaction with external actors

Note: Inspired by Ansell and Torfing (2014) and Vargo and Lusch (2008, 2004)

Table 1 demonstrates that both the public and the private sector have developed from an in-bound focus on innovation to a network-oriented approach to innovation that is based on interactions with external actors. In general, then, enhancing public innovation in healthcare seems to be guided by a network logic that leads public and private actors towards mutual

collaboration. Thus, through the involvement in PPI projects, private firms are increasingly playing a central role in generating public innovation by developing new solutions that target public sector needs (Sørensen and Torfing, 2012; Borins, 2008). However, the historical developments that have edged the actors towards this network logic are very different for public and private organizations, respectively.

The emergence of a networked governance approach for public organizations is related to the development of particular historical periods and ways of governing. The public sector found in Western democracies today is different from that found 30 years ago. The traditional bureaucratic form of governance, often termed Old Public Administration, was gradually supplemented and transformed by New Public Management (NPM) reforms in the 1980s and 1990s. With a focus on managerialism, NPM is primarily based on the introduction of management techniques from the private sector and on an increased marketization of the public sector (Hood, 1991). The most recent variant of public governance, which is often termed New Public Governance, is focused on a networked governance approach concerned with external collaboration as opposed to the intra-organizational approach and the input and output focus of NPM (Hodge and Greve, 2010).

In a similar manner to public sector organizations, the firms are guided by a network logic both in relation to the development of new innovations and in their attempts to commercialize these innovations. A network approach to commercialization is becoming increasingly dominant (Vargo and Lusch, 2008, 2004) and is oriented towards interaction with actors that are external to the firm. This stands in opposition to the in-bound focus that dominated firms in earlier decades. As such, firms' commercialization of new innovations developed through PPI projects includes interaction with potential customers in the external environment throughout the firms' commercialization activities (Chesbrough, 2003). The commercialization of innovations through interaction with external actors is characterized by initiating first sales and developing sales to multiple customers to profitably exploit what the firm produces (Aarikka-Stenroos et al., 2014; De Clercq and Voronov, 2011; Anderson et al., 2010).

What sometimes disrupts commercialization despite a seemingly common departure in a network logic is the prevalence of an NIH phenomenon. NIH is an obstacle to successful networked commercialization of new innovations, as it constrains the commercialization aspect of the innovations process (Katz and Allen, 1982) whereby new innovations are diffused and put into use by the customers and users (Hall, 2005; Van de Ven, 1989). NIH has been researched from the perspective of the organization influenced by NIH, e.g. in relation to knowledge sharing among individuals or projects dealing with an organization's R&D activities (Lichtenthaler & Ernst, 2006; Michailova and Husted, 2003), organizations' absorptive capacity and innovation culture (Herzog and Leger, 2010), and organization's perspective towards open innovation (Chesbrough, 2006). See Appendices 1 and 2 for a more detailed overview of the characteristics of NIH in the innovation literature. Common to all is, however, is an understanding that NIH is an attitude-based bias towards knowledge (e.g. new ideas and innovative technologies) derived from a source or contextual background that is external to the organization, group, or individual (Katz and Allen, 1982; Kostova and Roth, 2002). As such, individuals have a generally negative attitude towards knowledge, ideas, or technologies of external origin (Burcharth et al., 2014;

Bohner and Dickel, 2011). In explaining NIH, much literature draws on social psychology that focuses on rejection behaviors of individuals and groups (Pillar, 2014). Some key examples of different terms used in the literature to describe NIH are: 'Not invented here' syndrome, 'not invented here' attitude, and 'not invented here' mindset. In particular, health professionals such as doctors and nurses may be skeptical about adopting an innovation from an external source because they may be dominated by a 'we know best' mindset (Chilingerian et al., 2005; McNeill, 2013; Maccoby et al., 2013; Trusko et al., 2013). This may be due to health professionals' responsibility for people's lives and well-being which possibly causes them to rely more on their own expertise. This mentality may produce an NIH phenomenon which inhibits the adoption of new innovations or knowledge developed 'outside' the organization. This happens despite a common rooting in a network logic that paves the way for collaborative innovation partnerships. So even though more and more welfare innovations are developed through collaborative innovation projects across the public and private sector (Sørensen and Torfing, 2012; Vargo and Lusch, 2008), challenges remain when it comes to diffusing and commercializing jointly developed welfare solutions. How firms deal with this will be the focus of the rest of the article. We focus on how a group of firms expresses their experience of an NIH orientation at Danish hospitals and how they respond to this in their efforts to find a way to diffuse and commercialize their solutions.

Research design

We selected a multiple case study approach for this study. The cases are four PPI projects that all focus on developing welfare innovations targeting Danish public healthcare. Comprehensively exploring a few specific cases seems appropriate as this generates a wealth of information about the phenomenon in focus (Miles and Huberman, 1994). Through the multiple cases, the study aims to provide a rich in-depth understanding (Eisenhardt and Graebner, 2007) of PPI firms' experience of NIH while they endeavor to commercialize welfare innovations in the specific empirical settings of healthcare. Furthermore, the multiple case study approach is particularly suitable when phenomena are investigated in their natural environments and where the phenomenon under investigation is difficult to isolate from its surroundings (Yin, 2003); and because the investigation of firms' experience of NIH cannot be separated from the surroundings in which they manifest themselves, a multiple case study appears the most appropriate method.

The four case studies are embedded in the context of Danish public healthcare. Since the national structural reform of 2007, Danish healthcare has consisted of 5 regions which have responsibility for the Danish hospitals and 98 municipalities responsible for the prevention and rehabilitation of patients following discharge from hospital. In relation to the structural reform, plans were made to reduce the number of hospitals and to allocate considerable financial resources to building sizable new hospitals within the next decade (Ministry of Interior and Social affairs, 2009). The processes related to the building of new hospitals have triggered numerous PPI projects. Table 2 provides an overview of the four cases.

Among the four cases, Case 1 was selected as an extreme example that may serve to provide an in-depth illustration of how a commercializing PPI firm experiences and responds to what is perceived as an NIH phenomenon at Danish hospitals. Specifically, the case was selected

because it generates rich process information about the studied phenomenon (Flyvbjerg, 2006) and promises to provide greater detail about the phenomenon in question than the other cases would (Siggelkow, 2007). The phenomenon in focus is NIH which hampers the firm in case 1 from commercializing broadly in Danish healthcare. The three other cases serve to further illustrate the experiences derived from Case 1.

Table 2: Four cases in which NIH is experienced by PPI firms

PPI projects	Firms' business area	Firm size*
Case 1 Development of a telemedicine solution aiming to provide treatment and monitoring of a hospital's chronic obstructive pulmonary disease (COPD) patients from their homes following their discharge from the hospital. The public project partner was a hospital.	Manufacturer of healthcare products whose main focus is on telemedicine solutions.	Small
Case 2 Development of a self-propelled person lifter for heavily overweight patients in hospitals. The public project partner was a hospital.	Manufacturing of healthcare products with a primary focus on lifts.	Small
Case 3 Development of a series of product concepts for standard hospital and nursing beds used by bed-ridden patients/residents at municipal nursing homes. The public project partner was a municipality.	Designing and manufacturing electric linear actuator solutions.	Large
Case 4 Development of a telemedicine solution for virtual home visits at the homes of patients with chronic obstructive pulmonary disease (COPD) after their discharge from the hospital. The public project partners were a hospital and a municipality.	Provides services within 4 areas of business: assistance, rescue, healthcare and training.	Large

*NOTE: The classification of the size of the firms is based on the European Union's legislation on SME. Small firms have less than 50 employees, medium firms have less than 250, and large firms over 250 (Commission Recommendation of 6 May 2003 concerning the definition of micro, small and medium-sized enterprises (2003/361/EC. Official Journal of the European Union, L 124/36).

Case selection strategy

In 2014, the number of PPI projects amounted to over 250 and the majority of these, 177 projects, were established within Danish healthcare (Brogaard and Petersen, 2014). The four cases were selected from the pool of 177 completed PPI projects that all focused on developing welfare innovations targeted at the Danish public healthcare. They were chosen as they fulfilled the following criteria (1) the firms in the cases intended to initially commercialize the innovations developed through the PPI projects broadly within Danish healthcare by interacting with public actors at different hospitals, (2) the firms expressed explicitly themselves and on their own initiative that they had experienced a 'not invented here' (NIH) orientation at Danish hospitals, when seeking to commercialize their welfare innovations across hospitals, and (3) in response to NIH these firms have reshaped their practices and have succeeded in commercializing their welfare innovations internationally. The third criterion minimizes the

possibility that the innovative solutions are not relevant and thus helps ensure that innovations are rejected due to NIH.

Data collection

In order to strengthen the accuracy of the case study findings, multiple data sources were used. The primary data collection was based on semi-structured interviews. In addition hereto, project reports and documents from the four PPI projects were scrutinized and information about the projects was acquired through participation in PPI seminars and also conferences held in Denmark that disseminated more general knowledge about PPI. Also, public documents about welfare innovation were used to support the findings (e.g. from each of the 5 regions and Danish Regions which is the interest organization for the 5 regions in Denmark).

The semi-structured interviews were conducted with key public and private actors engaged in the four cases. Interviews with the 4 firm actors were conducted at the firms' headquarters and included open-ended questions about the innovation process in the PPI projects, particularly those with a focus on the firms' commercialization of welfare innovations. An additional interview was conducted with the managing director of the firm in the aforementioned extreme case (Case 1), and an additional visit to the firm's headquarters was made where (unrecorded) conversations took place. Additionally, interviews were conducted with public health professionals (a head of department and hospital manager) at the hospital where the welfare innovation from Case 1 had been developed and implemented. Finally, an interview was conducted with a doctor working at the hospital where the firm in Case 1 experienced NIH while aiming to commercialize the welfare innovation (Appendix 3 provides an overview of the interviews). Each interview lasted for about 1½ hours and was recorded, transcribed, and coded. To support the coding of the transcripts, the software program NVivo was used. Identifiable topics or themes related to the research question have been labeled as a way of guiding the analysis and coding the transcripts (Miles and Huberman, 1994), such as 'constraint to commercialize'. Coding makes it possible to systematically derive characteristics about the firms' commercialization and the experience of NIH by coding/labeling text passages, phrases or words in the interview transcripts (Appendix 3 provides an overview of the coding results for the four cases).

Findings

Case 1 serves as an extreme case that provides an in-depth understanding of how a firm experiences NIH in Danish healthcare over time as it aims to commercialize a new welfare innovation developed in the context of a PPI project. Furthermore, findings from all four cases illustrate that the PPI firms ultimately reshape their commercialization practices in response to experiencing NIH. Specifically, the firms in the four cases (including the extreme case) become increasingly internationally oriented as they encounter NIH.

The story of the extreme case – Case 1

Case 1 consists of a PPI project that focused on developing telemedicine for patients with chronic obstructive pulmonary disease (COPD). The telemedicine solution allows hospitals to provide treatment and monitoring of their COPD patients in their own homes. The project period

lasted for three years while the telemedicine solution was developed. The firm that engaged in the project was founded in 2002 as a spin-off of an existing IT firm. The firm's project partner was a Danish hospital located within the same region (the Region of Southern Denmark) as the firm. The project was partly financed through public funding, by the hospital, and by the firm. In total, the financial costs in the project accrued to 6-10 million Danish kroner (about 1 million Euros) of which 1.2 million Danish kroner were public funding (Danish Business Authority, 2009).

During the stage of the innovation process in which the telemedical solution was developed, the firm made contact with national Danish politicians. The firm intended to lobby for a change in the national law regarding the financial rates, which each hospital receives from the state when patients are hospitalized. The firm's desire for a statutory change was related to its aim to commercialize to multiple Danish hospitals and to the diffusion of its telemedicine solution. In the course of the firm's efforts, it was realized that it was necessary to increase the hospitals' incentive to implement telemedicine solutions. The firm therefore aimed to ensure that hospitals would receive financial compensation when providing treatment and monitoring of their COPD patients in their own homes. Among others, the Minister of Health visited the firm after the telemedicine solution had been tested and documentation of the time-saving benefits, etc., had been prepared. Eventually, a law change was passed by the national assembly.

In the course of the firm's interaction with the politicians, it focused on the possibility of commercializing the telemedicine solution broadly to multiple hospitals as it aimed to enhance their incentive to purchase and implement telemedicine solutions. The firm focused on broad commercialization within the healthcare system and on generating commercial value from the welfare innovation being developed in the PPI project: *We only engage in a project when we see some real possibilities... When we are at the end of a project period and calculations are made, then there is one thing that dominates above all, and that is economy.*

After the project period had concluded, the hospital that was the firm's project partner purchased the telemedicine solution from the firm and implemented it at the hospital. Subsequently, the firm put efforts into commercializing the telemedicine solution to other Danish hospitals, but did not succeed in doing so. The firm made contact with several hospitals across various Danish regions and presented test documentation related to the benefits of implementing the product (e.g. time-saving benefits). Throughout the firm's commercialization activities, it experienced NIH as it interacted with health professionals. There appeared to be a general tendency of rejection towards the new product: *When you get out to a hospital outside the region and tell them about this product, they say that it sounds good, but this is not how they treat their patients... They want to give them a treatment based on their own invention, and that's how it is. Every region has initiated a project concerned with COPD, whether it is a touch screen or a box or whatever. Everyone has done it later (than us), but no one will buy something that works, because you want to invent it yourself.*

The firm did not succeed in commercializing broadly by diffusing the telemedicine solution across hospitals within Danish healthcare. To illustrate this commercialization challenge more comprehensively, one commercialization activity is exemplified. This activity is focused on one of the hospitals where the firm attempted to commercialize the telemedicine solution.

The firm made an arrangement with a hospital situated in another Danish region. The firm gave the hospital the opportunity to use the telemedicine solution for free during a two-month trial period. The firm did this to allow the hospital to try out the product before deciding on a purchase. However, the hospital did not subsequently purchase the telemedicine solution. Instead, the hospital eventually initiated its own three-year PPI project aiming to develop a similar telemedicine solution targeting COPD patients. The firm explains this in the following statement: *I tried to offer the product for free to this hospital for six months in order to gain access to the hospital. Subsequently, they developed something by themselves. This just proves that it is not about that – it is because they want the recognition for their own work. They do not want to buy something made in our region.*

The PPI project initiated by the hospital in the other region is the project described in Case 4. The large firm involved in this project also experienced commercialization challenges as it was constrained in commercializing broadly during the PPI project period. The reason for this was related to a doctor from the hospital involved in the PPI project. This doctor was concerned with keeping the knowledge in the PPI project inside the boundaries of the project and did not want to share knowledge with other hospitals during the project period. The doctor thereby restricted the firm's potential of contacting other hospitals to commercialize through a network approach by making contact to potential customers. The doctor explains that he had a discussion with the firm that was engaged in the project regarding its contact to other hospitals: *It is something which has been a bit of a challenge because it is a private organization which has to make money. So, of course, they have been trying to see if they could sell it [the telemedicine solution] in other places. And there was a time where we had a small dispute about this... 'Are you benefitting from the effort and 'heart blood' we have put into this project, and then maybe you begin to sell it elsewhere...' So, we had to talk about setting up some rules of the game about this. And then we have talked openly about it.*

The doctor seemed concerned with *not* sharing the knowledge generated in the PPI project. As such, NIH does not just relate to rejecting the implementation of innovations and knowledge from external sources; it also limits sharing of innovations or knowledge with others – at least during the period in which the new innovation is being developed.

This lack of knowledge sharing in relation to welfare innovations seems to be acknowledged by the Danish Regions, a central organization comprising all the five regions in Denmark: *The regions are good at being innovative when it comes to new effective solutions. But the regions are less apt at using other regions' innovativeness (Danish Regions, 2014).*

The reason for the lack of knowledge sharing is explained by the presence of a certain culture within the healthcare system; one that is associated with the prestige and legitimacy of being the prime supplier of new knowledge: *There is a long tradition within healthcare to connect the role as a knowledge supplier with high prestige and authority. It is a part of the culture that the ones who are in front with knowledge are the best (Danish Regions, 2014).*

The hospital in the other region than the firm in Case 1 used the slogan 'Being on the forefront of health' at the hospital's webpage in relation to a description of the PPI project where

the similar telemedicine solution was being developed. This phrase appears to be an indirect way of positioning the hospital as a frontrunner in the development of welfare innovations in healthcare rather than adopting them from other hospitals. As such, the wish to ‘be on the forefront’ may limit adoption of welfare innovations developed elsewhere.

Eventually, the firm in Case 1 focused on export and changed its commercialization practice. Instead of interacting with Danish hospitals, it started to explore alternative avenues and to investigate the structural set-up of healthcare systems in other countries. A year after the project period concluded, the firm succeeded in initiating its first international sale as it commercialized the telemedicine solution to a Norwegian hospital. Subsequently, the firm commercialized the telemedicine solution to more hospitals within Norwegian healthcare and it also started to focus on the British healthcare system. Thus, the firm’s commercialization practice was eventually reshaped in response to the experience of NIH in Danish healthcare.

Supporting evidence from the illustrative cases – Cases 2, 3 and 4

In the three illustrative cases, the PPI firms also experienced NIH, and this appears to have influenced the firms’ commercialization practices. Like the firm in Case 1, those in the other cases responded to NIH. Specifically, most firms began focusing on international markets different from those encountered in Danish healthcare. For example, the small firm in Case 2 stated: *What goes wrong in the process, this is clear, is that the Danish health care sector does not follow up on implementation and commercialization when an innovation has been developed. This means that we end up selling our innovation internationally.*

Also, Cases 3 and 4 are internationally oriented with respect to commercialization of PPI solutions. For example, the firm in Case 3 stated: *And the export sale grows. Where we used to have more sales in Denmark and our first thought always was that we needed to cover the whole country before we did anything else, then now our board says that it is too complicated in Denmark and we need to export.*

This is in line with the firm in Case 4 that states: *We use the knowhow gained in Denmark to export internationally.*

However, in comparison to the smaller firms (Cases 1 and 2), the two large cases (3 and 4) appear to be primarily focused on using PPI projects in Denmark as experimental test settings before focusing on export. In contrast, the smaller firms appear more eager to export their solutions at a faster pace. As smaller firms tend to possess fewer resources than larger firms, the firms in Cases 1 and 2 may be more dependent on rapid commercialization of their PPI solution.

Discussion

Innovation processes are initiated when a new idea is being developed and generates commercial value (Twiss, 1992). Innovation processes therefore embrace both the development and the commercialization of a new innovation. The new welfare innovations presented in the four cases all originate from new inventions that are transformed into innovations through collaboration between public and private actors in PPI projects, spurring potential value for

citizens, public servants, and private firms. Furthermore, a primary focus of the study was on firms' commercialization of welfare solutions co-created with public actors. Specifically, we followed closely how firms seek to generate commercial value from their new welfare innovations. The findings suggest that challenges exist in relation to the commercialization aspect of the innovation process.

The PPI firms experience an NIH phenomenon that restricts the commercialization of welfare innovations across Danish hospitals. Moreover, our findings indicate that the firms perceive the NIH phenomenon as counter-intuitive as there is an expressed need for new welfare innovations in the national agenda due, among others, to the demographic challenges associated with an aging population (Klitkou, 2011). This societal challenge was characterized as a 'wicked problem' which cannot be solved by a single actor alone because of its complexity (Rittel and Webber, 1973); hence, PPI has been introduced repeatedly in the Danish healthcare sector.

Despite the prevalence of a network logic across the public and private sector, the multiple case study gives important insight into why some firms may not succeed in diffusing their welfare innovation to different hospital contexts. Rather, the firms respond to NIH by becoming more internationally-oriented as they explore the opportunities for exporting their welfare solution. Case 1, in particular, showed proof of substantial changes in the firm's strategic commercialization focus. Instead of managing relations to key public actors at well-known hospitals in the home market, the firm eventually started focusing on the identification of other international healthcare markets and key actors at international hospitals in order to build new networks. Thus, the firm still maintained a network approach to commercialization through identification and interaction with potential customers (Håkansson et al. 2009). However, these are now located beyond the home market, within healthcare systems that are less familiar to the firm. It eventually succeeded in commercializing to international healthcare systems. The shift in the firm's focus was particularly noticeable in the continuous change in the firm's daily commercialization practices, which eventually became dominated by the accumulation of knowledge about other healthcare systems based on travels, particularly to British hospitals, and international healthcare exhibitions and conferences (e.g. the American 'Future of Health Care' conference in Silicon Valley). The experience documented in the extreme case is further supported by the three illustrative cases as their experience of NIH and their reactions to NIH were quite similar to those of the extreme case firm. All of the firms change their commercialization practice by focusing on measures aiming to export their welfare solutions to an international market. As such, the firms' response to NIH indicates that welfare innovations developed in PPI projects may create export opportunities for private firms if they are capable of reshaping their commercialization practices.

It is only fair to mention that from a hospital's perspective there may be a logical rationale for the rejection of a welfare innovation developed elsewhere in the healthcare sector if the innovation does not fit into the hospital's context. As organizations are different and contingent upon the local context in which they are situated (Scott, 2003), each hospital in the healthcare system is different in regard to location, practices, organizational culture, etc. Therefore, health professionals may reject new welfare innovations simply because the innovation is not in line with prevailing standards and practices at a specific hospital. As such, it is not only the origins of new innovations that determine if it becomes successful, but also the

context in which the innovative product or service is implemented (Roberts and King, 1996). Naturally, private firms may have to consider this when developing new welfare solutions. To take an example, in Case 1, the PPI firm focuses on commercializing a standardized welfare innovation across hospitals within the healthcare system, and not on adapting the welfare innovation to fit different hospital contexts. This may well explain why the firm experiences an NIH phenomenon. However, it seems possible for firms in general to adapt specific welfare innovations to specific hospitals, but the point is how private firms react to the challenges they face. Based on this multiple case study, the firms react to the prevalence of a NIH phenomenon by reshaping their commercialization practices as they search for other opportunities to diffuse and commercialize their solutions. As firms decide to respond in this manner, the Danish healthcare system may risk 'losing' central welfare innovations if similar innovations are not developed through another PPI project, as seen in Case 1. Therefore, welfare innovations may be exported instead of being put into use in the home market where they could well enhance public innovation in healthcare and create public value.

Nevertheless, hospitals' rejection of new welfare innovations developed elsewhere does not seem to place limits upon their use of networked governance, as manifested in the establishment of new PPI projects. As illustrated in Case 1, two similar welfare innovations were developed across hospital contexts through the use of PPI projects. The hospital which rejected the purchase and adoption of the firm's welfare innovation subsequently initiated its own PPI project where a similar welfare innovation was developed. The doctor engaged in the PPI project at this hospital focused on keeping the knowledge inside the boundaries of the project during the project period. As a result, the firm involved in the project was restricted from initiating commercialization activities and thus restricted from sharing knowledge about the new welfare innovation across hospitals in order to initiate the first sales. This runs contrary to the networked approach that firms have to engage in commercialization where they interact with multiple potential customers during the development process (Clarke et al., 2015).

It can be assumed that the hospital wanted to appear to be a prime knowledge supplier of new welfare innovations, which is rooted in a 'we know best' mindset (Chilingerian et al., 2005). It positioned itself as a 'forerunner' when it comes to developing new welfare innovations, which indicates a need to appear to be a prime knowledge supplier. This need may derive from an institutional pressure in society related to an increasing focus on public innovation and the need to be innovative in order to solve some of society's 'wicked' problems. The field of healthcare appears to be influenced by an institutional pressure relating to normative societal expectations (Mizruchi and Fein, 1999; DiMaggio and Powell, 1983). Over the past decade, the political focus on the public sector's need to be innovative has grown intensely (Ansell and Torfing, 2014). As such, there seems to be societal expectations that public healthcare organizations should be innovative. This may precipitate a mindset according to which hospitals want to appear to be the most innovative or a 'forerunner'.

Conclusion and implications

This article contributes to collaborative innovation literature focused on the enhancement of public innovation through the use of cross-sector collaboration such as PPI projects. There is a

lack of research on how private firms seek to commercialize new innovations with a view to creating public innovation in practice across organizations in society (Evald, 2014) and how they experience and respond to the commercialization process. We emphasize commercialization as a central aspect of the innovation processes. Innovation processes also include commercialization whereby new innovations gain commercial success through diffusion across organizations in society (Van de Ven, 1989; Schumpeter, 1939), and the present study indicates that firms face commercialization challenges. The firms experience an NIH phenomenon that constrains the diffusion of welfare innovations across Danish hospitals, where they could be put into practical use to enhance public innovation. The study also shows that PPI firms manage to commercialize welfare innovations internationally by reshaping their commercialization practices.

To summarize, as exemplified through an extreme case and three illustrative cases, the findings show: 1) how NIH is experienced by firms that aim to commercialize welfare innovations developed through PPI projects. The firms' experience of NIH is backed by the innovation literature that states that an NIH orientation exists, particularly among healthcare professionals. 2) Moreover, our findings demonstrate that the firms seem to reshape their commercialization practice in response to NIH as their networked commercialization activities become internationally oriented instead of home-market oriented. Future research is warranted on the commercialization of public sector innovations developed through cross-sector collaboration in other fields than healthcare. The energy industry is a potentially interesting field of study in this context as this policy area that has gained increasing political attention in the national and EU agenda, which is analogous to the development of new welfare innovations.

The implications of our findings for the public sector may be summarized as knowledge sharing challenges. A central recommendation to public managers and policy makers dealing with public innovation is to create spaces where multiple public and private actors may connect and share knowledge about new ideas and innovative products or services. Such spaces may be created by establishing consortia formation requirements in larger PPI projects that include various Danish regions. Public actors may benefit from forming consortia across regions and/or hospitals as this may enhance the possibility for knowledge sharing and the opportunity to learn from other public organizations. It may also enhance joint ownership of new welfare innovations across hospitals and health professionals, which may help reduce the desire to develop 'one's own' welfare innovation – innovations that are similar to the already existing ones. Moreover, the involvement of multiple firms in PPI project consortia may enhance knowledge spill-over between firms – for instance between those with little experience with PPI in healthcare and those which have been engaged in a portfolio of PPI projects. In particular, small firms may benefit from larger firms' access to established knowledge pools in well-established networks (e.g. in the healthcare industry), while larger firms may benefit from small firms' innovativeness (Colombo et al., 2006).

Based on our findings, a central recommendation to firm managers is to develop an awareness of the environment in which their potential public customers are situated. In this study, the NIH phenomenon is evident in the Danish hospital environment. NIH seems to be rooted in a 'we know best' mindset, and the prestige associated with being a prime knowledge supplier ultimately seems to shape and the hospitals' predilection for local PPI projects. A key implication for PPI firms is that managers need to learn about more intangible aspects (such as

NIH), which could be influencing potential public customers' attitudes towards new innovations. This knowledge may be achieved through a long learning process involving continuous interaction and development of multiple cross-sector networks with key public actors including health professionals, hospital managers, politicians, etc. As such, it may be beneficial for firms to engage more in public networked governance and participate in multiple PPI projects.

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Appendix 1: NIH literature

Overview of NIH literature, by journals, authors and research areas

Journals	Authors	Research areas
Management Science	Hauser (1998)	New product development (R&D)
R&D Management	Cheng & Wang (2008)	
R&D Management,	Katz & Allen (1982)	
Nature Reviews Drug Discovery	Lau & Rond (2006)	
Journal of Product Innovation Management	Ragatz et al. (1997)	
Administrative Science Quarterly	Cohen & Levinthal (1990)	
Journal of Technology Transfer	Greiner & Franza (2003)	
Journal of Product Innovation Management,	Griffin & Hauser (1996)	
Journal of Technology Transfer	Kathoefer & Leker (2010)	
Administrative Science Quarterly	Tuschman & Anderson (1986)	
Technovation	Burcharth et al. (2014)	Open innovation
International Journal of Technology Management	Herzog & Leker (2010)	
R&D Management	Chesbrough & Growther (2006)	
R&D Management	Gassmann (2006)	
International Journal of Technology Management	Bessant (2008)	Management (e.g. knowledge management, innovation management, group relations)
Journal of Workplace Learning	Dealtry (2008)	
R&D Management	Lichtenthaler & Ernst (2006)	
Organization Science	Lichtenthaler et al. (2010)	
Knowledge and Process Management	Lilleoere & Hansen (2011)	
California Management Review	Michailova & Husted (2003)	
International Journal of Production Economics	Roy & Guin (1999)	
Interfaces	Shycon, 1978	
Social Influence	Adarves-Yorno et al. (2008)	
Annals of Business Administrative Science	Takahashi & Inamizu (2012)	
Annual Review of Psychology	Bohner & Dickel (2011)	
Academy of Management Perspectives	Antons & Pillar (2015)	
Strategic Management Journal	Szulanski (1996)	
Advances in Health Care Management	Chilingerian et al. (2005)	

Appendix 2: Dominatant concepts in NIH literature

An EBSCO Host database (Academic Search Premier and Business Source Complete) was used to identify NIH articles. As there is no clear definition of NIH, the first search was followed by a snowballing approach. Specifically, attention was paid to the terms and descriptions of the NIH phenomenon used in the articles found in the first search and additional author references used in relation to these were identified.

Overview of the search approach used in EBSCO Host

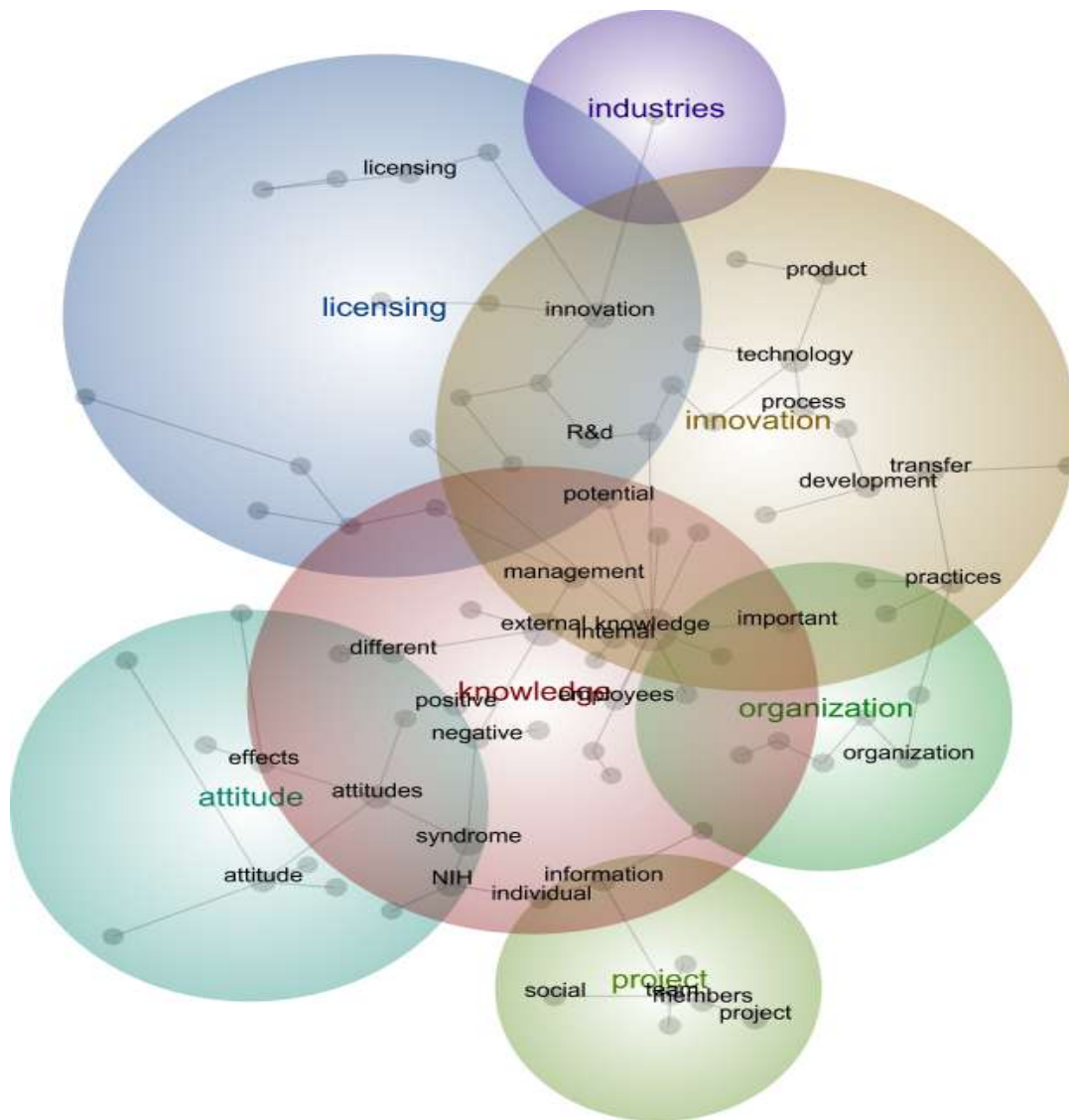
	Search words and total number of articles	Number of articles selected
First search*	Search words: Not invented here Number of articles: 43	18
Second search	Additional articles found through identification of new references of the articles selected for review	12
Total amount of articles	Selection of 30 articles, which hereafter is analyzed	30

*The keywords, abstracts and introductions were read and any relevant articles were selected for further review.

Results from Leximancer

All articles have been registered in the textual software program Leximancer. Subsequently, the program automatically conducted a contents description by identifying the most frequently appearing concepts. Concepts are collections of words that generally travel and occur together throughout the literature. Together with the most frequently occurring concepts, words that frequently co-occur with each concept are also identified in the program (Leximancer, 2011). The results produced by the program demonstrate that concepts related to knowledge and innovation is the most dominating ones throughout the NIH articles.

The circles in the following figure reveal the most dominating concepts identified in the literature on NIH. The black text inside the circles represents frequently appearing words related to each concept.



Concepts ranked by their weight in the NIH literature

Concept	Relative count
Knowledge	100%
Innovation	64%
Project	20%
Organization	19%
Attitude	19%
Licensing	19%
Industries	01%

Appendix 3: Data overview

Overview of the coding results for the four cases in which PPI firms experienced NIH as a constraint to commercialization of welfare innovations developed in PPI projects

PPI projects	Category/code	Quote examples (PPI firms)
Case 1 Development of a tele-medicine solution aiming to provide treatment and control of a hospital's chronic obstructive pulmonary disease (COPD) patients in their homes after discharge from the hospital. The public project partner was a hospital.	<u>Category:</u> Diversification – commercialize broadly <u>Category:</u> Experience of NIH as a commercialization constraint in DK	- We only engage in a project when we see real possibilities. - They want to provide treatment based on their own invention, and that's how it is.
Case 2 Development of a self-propelled person lifter for heavily overweight patients in hospitals. The public project partner was a hospital.	<u>Category:</u> Diversification - commercialize broadly <u>Category:</u> Experience of NIH as a commercialization constraint in DK	- With these care products we are unique on the market for products that offer flexibility and such. - There are a lot of small 'kingdoms'. There are a lot of conflicts of interest in this.
Case 3 Development of a series of product concepts for standard hospital- and nursing beds used by bed-ridden patients/residents at municipal nursing homes. The public project partner was a municipality.	<u>Category:</u> Diversification - commercialize broadly <u>Category:</u> Experience of NIH as a commercialization constraint in DK	- It is obvious that there is something called 'time to market', and we know that if we are not fast enough, then someone else will be faster than us. - I think that you are afraid that if you just adopt the neighbors' things, then you do not get the recognition for developing something new yourself. Then it is just something which you have taken from another hospital.
Case 4 Development of a tele-medicine solution for virtual home visits at the homes of patients with chronic obstructive pulmonary disease (COPD) after their discharge from hospital. The public project partners included a hospital and a municipality.	<u>Category:</u> Diversification - commercialize broadly <u>Category:</u> Experience of NIH as a commercialization constraint in DK	- There are markets where we sell a product, where we in Denmark have not started to introduce it yet, even though the product has been developed in a project in Denmark. - Then there is a lot of competition among the regions. And when it is something that we have in the North Denmark Region, then you do not want it in the Central Denmark Region or in the Region of Southern Denmark.

The table provides an overview of the interviews conducted with the private firms in the four cases.

Cases	Firm respondents
Case 1	<ul style="list-style-type: none">• Managing director
Case 2	<ul style="list-style-type: none">• Key account manager, Medline & Careline Department
Case 3	<ul style="list-style-type: none">• Regional manager
Case 4	<ul style="list-style-type: none">• Managing director

Overview of the interviews conducted with public stakeholders in relation to case 1

Public organization	Public respondents
Hospital in the Central Denmark Region	<ul style="list-style-type: none">• Chief doctor and head of department
Hospital in the Region of Southern Denmark	<ul style="list-style-type: none">• Head of hospital section for Operation and IT• Doctor and managing director of the hospital board